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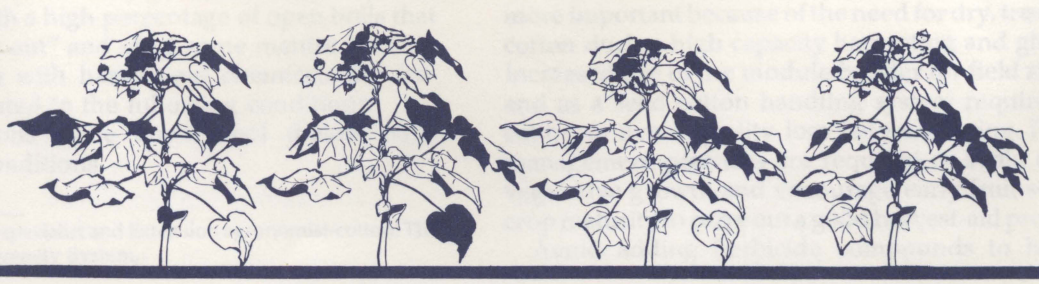
COTTON HARVEST-AID CHEMICALS



Texas Agricultural Extension Service • Zerle L. Carpenter, Director • The Texas A&M University System • College Station, Texas

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COTTON HARVEST-AID CHEMICALS

Robert B. Metzer and James Supak*

As the name implies, harvest-aid chemicals prepare the cotton crop for harvest by reducing foliage and plant moisture that interfere with harvesting operations. Harvest-aid chemicals are generally classified as defoliants, desiccants and growth regulators.

True defoliants are chemicals that cause abscission and shedding of leaves earlier than normal but do not necessarily kill the entire plant. Defoliation is usually a milder treatment than desiccation, although further plant development, including boll maturation, stops after the chemical is applied.

Desiccants are chemicals that kill plant tissue and cause rapid loss of water from the foliage. Plants usually are killed so rapidly that defoliation cannot take place and leaves frequently remain attached to the plants. Desiccation of the entire plant is necessary in areas where cotton is stripper-harvested. In some instances, low application rates of desiccants may result in defoliation only, while high defoliant rates together with high temperatures can cause some plant desiccation. For difficult-to-kill cotton, apply a defoliant to remove leaves and then follow with a desiccant. This combination, which drops leaves before desiccation, improves grades and reduces ginning cost.

Growth regulators, a relatively new class of harvest-aid compounds, improve the maturity processes, such as boll opening, and aid in shedding late season squares and small bolls. One plant regulator, PREP® applied at high rates also has good defoliation action under favorable conditions and frequently eliminates the need for additional defoliation treatment.

Although many factors are involved in getting good results from a defoliant or desiccant, plant and weather conditions during and following application are of major importance. Good results from harvest-aid chemicals usually are obtained when applications are made under the following conditions:

- Warm, calm, sunny weather
- Soil moisture relatively low but sufficient to maintain cotton plant in active growth condition without moisture stress
- Soil nitrogen levels relatively low
- Leaves active and uniformly expanded on plants
- Little or no secondary growth evident on plants
- Plants with a high percentage of open bolls that have "cut out" and shed some mature leaves

Poor results with harvest-aid chemicals are frequently attributed to the following conditions:

- Applications made under cool (below 60°), cloudy conditions
- Prolonged periods of wet weather following treatment
- Plants in vegetative growth state with low fruit set
- Plants severely moisture-stressed with tough, leathery leaves at time of treatment
- High soil moisture and nitrogen levels which contribute to rank, dense foliage and delayed maturity
- Plants exhibiting secondary growth following a "cut-out" period
- Improper calibration of application rates and poor spray coverage

TIME OF APPLICATION

The percentage of open bolls is still the best guide for determining when to apply harvest-aid chemicals. A defoliant may be applied when 65 percent or more of the bolls are open. Cotton with rank growth should have at least 80 percent of the bolls open before desiccating. Mature, unopen bolls are firm, cannot be dented by pressure exerted between the thumb and forefinger and cannot be cut easily with a sharp knife. At this stage, fiber and seed development is essentially complete, and only minimal reduction in lint yield and quality will be caused by chemical treatment. On the other hand, harvest-aid application made too early can have the following adverse effect:

- Reduced lint yield
- Reduced micronaire value
- Lower seed grade
- Lower seed quality for planting purposes
- Reduced fiber strength

The maturity of cotton fiber and seed cannot be hastened through the use of harvest-aid chemicals. Only time and favorable weather mature cotton. However, harvest-aid chemicals may promote more rapid opening of mature bolls and prepare the crop for earlier harvesting.

MANAGING HARVEST-AID PROGRAM

Proper use of harvest-aid chemicals becomes even more important because of the need for dry, trash-free cotton during high capacity harvesting and ginning. Increased use of the module builder for field storage and as a seed cotton handling system requires dry cotton to avoid quality loss before ginning. Proper management practices are required to avoid excess vegetative growth and encourage early fruit set and crop maturity to carry out a good harvest-aid program.

Avoid adding herbicide compounds to harvest

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aids to improve weed control unless such mixtures have label approval. For example, 2,4-D compounds are not approved for use with defoliants or dessicants in cotton. Since residue tolerances do not exist for 2,4-D compounds in cotton, serious action could occur if these residues were detected.

Treat only sufficient acreage to stay ahead of harvesting operations. If a second application is required, use a chemical with a different active ingredient to stay within the safe residue tolerance. When cotton reaches desired maturity, check weather forecasts to avoid as much unfavorable weather as possible during the application period. After applying a desiccant, a 1- or 2-week "curing out" period is required before stripper-harvest. Regrowth and barky cotton can result from either stripping too early after applying a desiccant or delaying the stripping operations too long after desiccation. Seed cotton and all plant parts should be dry before stripping. Cotton is dry when it fluffs well and plant parts are dry and crisp.

SECONDARY GROWTH

Development of secondary growth is a frequent problem following harvest-aid treatments. Conditions that favor foliage regrowth are late season periods of warm, wet weather on a crop with a high percentage of open bolls. Plants with unopen bolls or young, developing bolls are less likely to produce secondary growth, although application made at this stage can result in reduced lint quality and yield.

Secondary growth is difficult to control since young foliage does not form abscission layers or shed as older leaves do. Also, certain cotton varieties do not readily form abscission layers even on older leaves and will not defoliate properly. Dessicants such as arsenic acid, which completely kill plant tissue, are fairly effective and can be used under these conditions. Combinations of these compounds such as Gramoxone® with chlorate- or phosphate-type defoliants are also being used to improve control of secondary growth. The defoliant, DROPP®, can effectively reduce secondary growth when the temperature is relatively high following treatment. Read and follow the label carefully when mixing different harvest-aid chemicals.

To reduce gin trash, schedule harvesting after desiccation during the period when secondary growth is limp but not brittle. In all situations, delay harvesting for the time period specified on the chemical label.

INSECT CONTROL

Harvest-aid chemicals play an important role in early stalk destruction by reducing boll weevil, pink bollworm, bollworm and tobacco budworm populations. Some insecticides can be added to certain harvest-aid chemicals to reduce over-wintering boll weevil populations. For example, Guthion® or methyl parathion can be mixed with arsenic acid and phosphate-type defoliants for weevil control. DROPP plus methyl parathion tank mix can be used for insect control. However, do not add any organic compounds, including insecticides, to chlorate-type defoliants unless the label specifically states that such mixtures are permissible. Use combinations of phosphate-type defoliants (Folex and DEF) and phosphate insecticides with caution since greater toxicity may be encountered from the mixture than from either of the compounds used alone. See B-1204, B-1209 and B-1210, *Management of Cotton Insects* (Texas Agricultural Extension Service), for additional information regarding insecticide use in combination with harvest-aid chemicals.

CARE OF EQUIPMENT

Prepare application equipment by thoroughly cleaning spray tanks, pumps, lines and nozzles to remove residue left from prior usage. Check for nozzle wear by measuring output and shape of spray pattern. Once in the field, flush the sprayer system with clean water after each day's operation.

If phosphate-type insecticides have been used in the same spray equipment, thoroughly wash the spray tank and remove any dried deposits, especially if they occur on the fabric of aerial application equipment. Likewise, if chlorate-type chemicals have been used in the same spray equipment, thoroughly clean equipment before applying phosphate-type defoliants.

SAFETY WITH CHEMICALS

Avoid applying on windy days to reduce the hazard of spray drift to non-target vegetation. Lowering spray pressure and correcting nozzle size and spray angle also reduce drift. Protect the operator from spray drift. If chemicals come in contact with skin, wash immediately with soap and water. Store chemicals in a safe place out of reach of small children. Keep chemicals in their original, properly labeled containers and away from human food, animal feed, fertilizer, seed, insecticides and fungicides. Locate the storage area away from any fire hazard.

Rinse empty harvest-aid containers with water before burning. When filling spray tanks, avoid backsiphoning by keeping the water delivery hose out of the chemical containers. Never flush liquid from spray equipment into ditches or streams that could contaminate the water supply.

All harvest-aid chemicals have a tolerance or an exemption from tolerance designated for their proper use. Do not use until official federal regulations are issued governing the use of a specific harvest-aid chemical.

It is the responsibility of the manufacturer or formulator of a particular harvest-aid chemical to obtain registration with the Environmental Protection Agency.

GUIDE FOR USING COTTON HARVEST AIDS

DEFOLIANTS

Chemical name	Trade name	Percent active ingredients	Suggested rate per acre	Maximum registered rate (lb actual per acre)	Residue allowable (ppm)	Dilution data gallons water per acre		Comments
						Ground	Air	
Thidiazuron	DROPP 50WP	50.0	0.2-0.4 lb	0.6 lb	—	10-25	3-10	Apply DROPP when 60 percent or more of the bolls are open and remaining bolls to be harvested are mature. Do not use DROPP alone or in combination when night temperatures are expected to fall below 60° F. Use of DROPP on drought-stressed cotton may result in reduced defoliation. Rainfall up to 24 hr after application may reduce the effectiveness of DROPP. Adjuvants (crop oils or penetrating oils) added to DROPP can improve performance under adverse conditions. Tank mixes of DROPP and Def 6 or Folex 6 C improve defoliation. Tank mixes of DROPP + PREP improve defoliation and aid in opening mature bolls. Do not feed foliage from treated cotton plants or gin trash to livestock. Do not allow spray to drift onto trees or other non-target areas. DO NOT ALLOW THE SPRAY SOLUTION TO DRY IN THE APPLICATION EQUIPMENT. IMMEDIATELY FOLLOWING APPLICATION, CLEAN ALL SPRAY EQUIPMENT THOROUGHLY WITH DETERGENT AND WATER. A TANK CLEANER LABELED "CLEANER CONCENTRATE" IS EFFECTIVE IN REMOVING DROPP RESIDUES.
2,3 Dihydro-5 6-Dimethyyl 1,4-Dithiin	Harvade 5-F	49.0	6-8 fl oz	14 fl oz	—	10-20	minimum of 5	For first application, use 8 fl oz per acre plus a spray adjuvant. If a second application is required, use 6 fl oz plus adjuvant applied 5-7 days later. Do not permit spray to drift to citrus, broccoli, almonds, grapes, peppers, tomatoes, lettuce, alfalfa, sugar beets or winter wheats. A second application may be required in rank cotton or when night temperatures are below 55° F. for 3-4 days and if rainfall occurs within 6 hr after treatment.
Sodium Chlorates	-Drexel Defol	28.0	1-1½ gal	5.0	Exempt	10-20	5	Do not apply later than 7 days before harvest. Do not graze treated acres or feed gin waste to livestock. Clean spray equipment before and after use and do not allow wash water to contact plants. To avoid fire or explosion, check the label before mixing with insecticides. Use with adequate fire retardant. Keep contaminated clothing wet until washed. Refer to label and material safety data sheet before handling.
	-Drexel Defol 6	47.2	½-¾ gal	5.0	Exempt	15-20	5	
	-Tide Chlorate	27.2	1-1½ gal	5.0	Exempt	20-30	4-7	
	-Riverside Chlorate	29.5	1-1¼ gal	5.0	Exempt	10-20	5-10	
	-KM Sodium Chlorate	99.5	2 lb/gal H_2O 2 gal/10 gal H_2O		Exempt	10	10	
	-OXY Leafex-3	28.0	1-1⅓ gal	5.0	Exempt	Sufficient for good coverage	5-10	
	-Climax-3	28.0	1-1⅓ gal	5.0	Exempt	10-20	5-10	

Chemical name	Trade name	Percent active ingredients	Suggested rate per acre	Maximum registered rate (lb actual per acre)	Residue allowable (ppm)	Dilution data gallons water per acre Ground	Air	Comments
S, S S-Tributyl Phosphoro-trithidate	DEF-6	70.5	1½-2 pt	1.5	4.0 cottonseed 6.0 cottonseed	10-20	5-12	Folex 6EC may be applied to mature cotton when 50 percent or more of the bolls are open. Five to 7 days required for satisfactory leaf drop under favorable conditions. Under adverse conditions 10-14 days may be required for leaf drop. Apply specified rates per acre in recommended gallons of water to give thorough coverage. Use white diesel oil when night temperatures drop below 60° F. or if cotton plant is moisture-stressed. Higher rates may be necessary in rank cotton. Certain phosphate insecticides are compatible with DEF or FOLEX for late season boll weevil control. Once-refined vegetable oil at 1.5 pt per acre may be used with 1⅓ to 2 pt DEF-6. In rank cotton use up to 3 pt DEF-6 per acre with 1.5 pt vegetable oil. Avoid spray drift to other crops. Folex 6EC and DEF-6 are toxic to fish. Keep out of lakes, ponds and streams. Follow the label closely for mixing with desiccants.
Tributyl Phosphoro-trithioite	Folex 6 EC	70.5	1⅓-2 pt	1.5	0.25 cottonseed	10-25	5-10	
DESICCANTS								
Arsenic Acid	Cotton Desiccant L-10	75.0	1½ qt	4.4	4 as AS203 on cottonseed	4-10	4-10	Apply when air is calm and weather is clear and hot. Have 75 to 80 percent or more open bolls. Do not apply within 4 days of harvest. Do not graze treated area or feed gin trash from treated areas to livestock. Avoid contact with or drift to desirable plants or crops. Do not store in unlined metal containers. Triple rinse (or equivalent) containers, then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or incinerate if allowed by state and local authorities. If containers are burned, stay out of smoke.
	American Brand Cotton Desiccant	75.0	1-1½ qt	4.4	4 as AS203 on cottonseed	5	5	
	Farmers Cooperative Brand H-10; T-49 Cotton Desiccant	75.0	1-1½ qt	4.4	4 as AS203 on cottonseed	5	5	
	Hi-Yield H-10; T-49 Cotton Desiccant	75.0	1-1½ qt	4.4	4 as AS203 on cottonseed	5	5	
	Hi-Yield H-15 Premium Grade	75.0	1-1½ qt	4.4	4 as AS203 on cottonseed			
	Bullseye Cotton Desiccant	75.0	1-1½ qt	4.4	4 as AS203 on cottonseed			
Paraquat	Gramoxone Super	20.4	1½-2½ pt	0.5	0.5 on cottonseed	10-30	3-10	Apply when 85 percent or more bolls are open and remaining bolls to be harvested are mature. Do not make more than two applications. When foliage is dense, make two applications at the lowest recommended rates. Use a non-ionic surfactant at 1 pt per 100 gal of spray mix. Most effective [illegible] western areas of [illegible] state.
	Cyclone	29.1	1-2 pt	0.5	0.5 on cottonseed	10-30	3-10	

								Do not apply within 3 days of harvest. Do not pasture livestock in treated fields within 15 days after treatment. Remove livestock from treated area within 30 days before slaughter. Do not feed treated gin trash to livestock. Avoid getting in eyes or on clothing. This compound is extremely hazardous when ingested. Avoid getting material in mouth, feed or drink containers.
MIXTURES								
Glyphosphate	Roundup	41.0	1 to 2 pt plus 0.5 to 1% nonionic surfactant. For best results use 2 pt			15-25	5-10	Primary use is for cotton defoliation and regrowth inhibition. Treat after 60 percent or more of bolls are open and when youngest bolls are mature. Do not apply to cotton grown for seed. Allow a minimum of 7 days between application and harvest. Do not graze treated cotton fields or feed cotton foliage to livestock. Under adverse conditions such as cool temperature or drought, it may be necessary to retreat with a defoliant or desiccant.
+	Def-6	70.5	2 pt					
	or							
	Folex	70.5	2 pt					
Endothall	Accelerate	15.9	1-2 pt			10-30	3-10	Do not harvest within 3 days of application. Use nonionic surfactant at 1 pt per 100 gal of spray mix. Recommended for use on cotton to be stripper-harvested. Use the higher rates when cotton is green and considerable regrowth has occurred. See other comments pertaining to Paraquat usage noted above.
and	and							
Paraquat	Gramoxone Super	20.4	1½-2½ pt	0.5				
	Accelerate	15.9	1-2 pt			10-30	3-10	
	and							
	Cyclone	29.1	1-2 pt	0.5				
Endothall	Accelerate	15.9	1-3 pt			10-20	5-10	This mixture is labeled as a cotton desiccant. See comments pertaining to usage of sodium chlorate noted above.
and	and							
Sodium Chlorate	Sodium Chlorate	28.0	1½ gal					
Endothall	Accelerate	15.9	1½ pt			4-10	1½ gal minimum	Do not harvest within 4 days of application. When mixing, first add water, then add arsenic acid using agitation. Next, add accelerate and remaining water. Water containing minerals can cause solids to form. Test water to determine if it is satisfactory for this use. See comments pertaining to use of arsenic acid noted above.
and	and							
Arsenic Acid	Arsenic Acid	75.0	1-1½ qt	4.4	4 as AS203 on cottonseed			
PLANT REGULATORS—CONDITIONERS								
Ethephon	PREP	55.4	Boll opening	2	—	15-50	2-5	For opening bolls, apply when sufficient numbers of unopen bolls are mature to produce the desired yield. To prepare crop for defoliation (conditioning), treat with PREP 4 days or more before full defoliation treatment. Some shedding of small immature bolls and squares may be associated with treatment. Do not apply PREP if rain is expected within 6 to 8 hr. Weather and growing conditions may affect the boll opening rate and defoliation activity of PREP treatment.
			Conditioning	0.5-1	—	15-50	2-5	
			Boll opening 1⅓ pt (80° F. or higher) 2.0 pt (75°-80° F.) 2⅔ pt (65°-75° F.)					
			Conditioning ⅔ pt (80° or higher) 1⅓ pt (65-75° F.)					

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